Small Wind Column

Back to the Basics 7: Wind Resource Maps and Wind Site Assessments

How many times have you heard a person who is insistent on buying a wind turbine say, "It's always windy here," or, "We've got plenty of wind; it will generate all the electricity we need"?

On the other hand, wind is an energy resource with which many renewable energy practitioners are quite uncomfortable. With photovoltaics (PV) and the sun, you *know* your resource. It's bright, warm, and very reliable. Even when the weather is overcast, we know that the sun will come up every morning and go down every night (if it ever doesn't, we'll have other problems to worry about). There are even sun hour maps to quantify the amount of sunlight that falls on virtually every square foot of the planet. PV systems are simple to design for.

The same is true for anyone interested in a hydroelectric generator. Assuming decent snow and rainfall in a given watershed, the creek will rise in the spring or the river will run all year long. Local Soil and Water Conservation District offices track water flow and channel capacities, and can cite the historic highs and lows for most water-courses. Design your hydro plant within these extremes, and you'll never be without electricity.

But that wind. It is so unlike other renewable energies, so…*intangible*. Sometimes it's here, sometimes it's not. The wind seems so ephemeral, right? A very fickle renewable source of energy, right?

Maps used by wind farmers

Actually, that's not quite the case. Wind, like sunlight quantified as sun hours or water flow measured in a river, has been documented for decades. It is part of what we log as "climate." In many places, wind is definitely seasonal, while in other locations, there is a strong diurnal (daily) resource. The wind may not be as "reliable" as the morning sunrise , but it does have very distinct patterns and quantities.

Research institutions such as the National Renewable Energy Laboratory and Pacific Northwest Laboratory as well as companies including AWS Truewind, 3Tier, WindLogics, and others have spent considerable time and resources developing wind maps that characterize the wind resources in the U.S. These tools are used by wind farm developers to screen for windy areas having such attributes as wide open spaces, large tracts of farm land, and relatively near proximity to transmission lines. Once a location is identified, a developer will commission the erection of a meteorological tower to monitor the wind resource for a year or longer—a requirement for financing large wind farm projects given that financial institutions wish to minimize risk.

These same wind maps, the screening tools for wind farm developers, work well enough by themselves for siting small wind turbines, which do not require year-long site monitoring—provided one follows best practices for siting small wind turbines. (First and foremost of these practices is the "30 foot" rule covered in a previous Back to the Basics column, "Determining the Minimum Tower Height for Your Site.")

On the next page is the new wind map developed by AWS Truewind and NREL for my state, at 80 meters above "ground level." These are great screening tools for wind prospectors (that is, those who look for wind farm locations), as well as the basis for wind site assessors understanding local wind resources (more on these site assessors in a moment).

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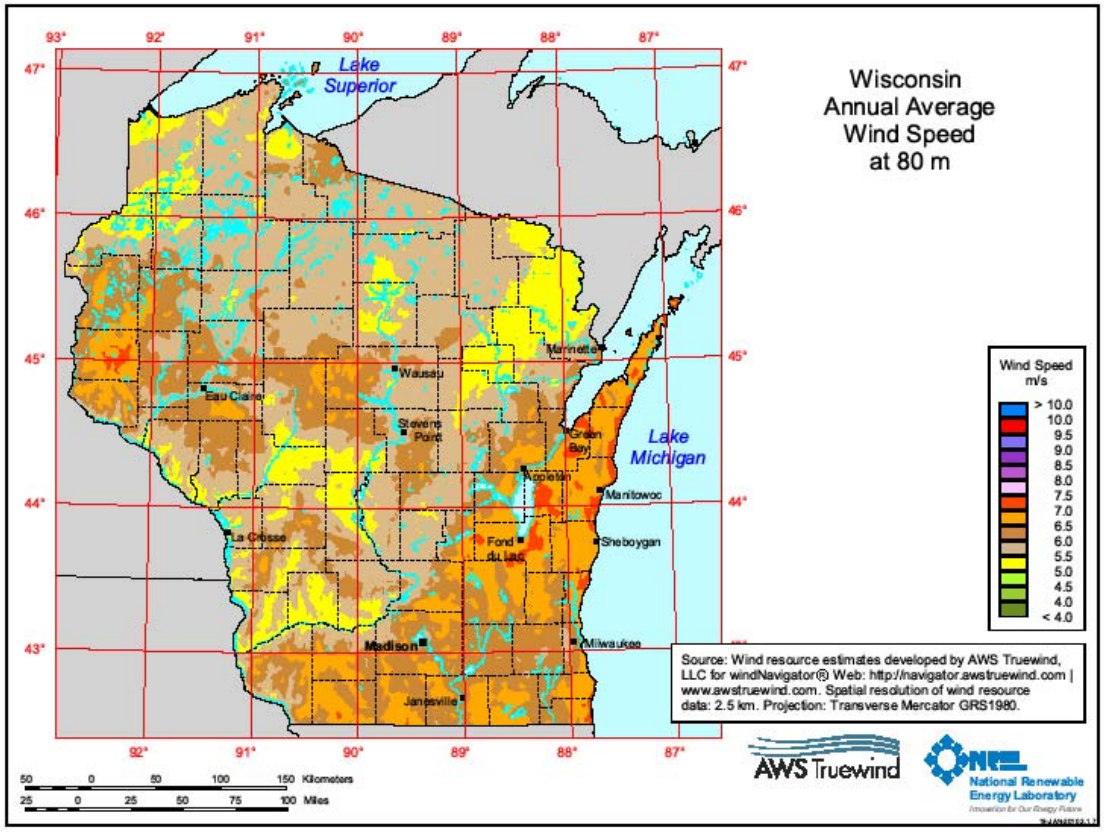

Tap the expertise of a pro

However, wind maps are not quite easy enough to use that anyone can pick one up and prospect for the wind. It takes quite a bit of training to interpret and understand what a wind resource map is saying. For example, a wind map will not provide adequate or accurate information for locations below the tree line of an area, on roof tops, in urban areas, at sites with very complex terrain, or in areas with a lot of ground clutter.

A person trained for the task, however, would be able to help you by using the wind maps and applying the information to such settings unique to small wind. Such experts, known as wind site assessors, are available for hire to evaluate the wind potential for a small wind turbine on your property. Such services are typically provided to residences, farms, businesses, and school districts, all of which are common locations for a small wind turbine for "behind the fence generation"—that is, where all the electricity is consumed on site to offset electricity that would otherwise be purchased from the local utility.

Among other things, a wind site assessor will be versed in such esoteric aspects of wind maps as:

- wind shear, which affects the wind speed as you extrapolate up or down in elevation from the wind map;
- displacement height, which affects the "ground level" at which the wind begins;
- turbulence intensity, a measure of the gustiness of the site;
- Rayleigh distribution, which affects the wind power density of the wind resource; and

the "wind rose," a graphic display which reveals the prevailing wind directions for the location and their wind power

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densities.

All of these parameters will affect the annual energy output, or kilowatt-hours per year, for the wind systems of interest. In short, none of this is as simple as referring to the manufacturer's product brochure to ballpark the amount of electricity a wind turbine will generate at your site.

So, what does such a service cost? A wind site assessment can cost anywhere from a few hundred dollars to a few thousand, depending on several factors, including the cost share offered by your state's public benefits program or your utility's renewable energy program, the complexity of your site and situation, the level of risk you are willing to assume (usually more risk for a smaller turbine), and the level of detail you wish to receive in the report.

If you balk at spending a few hundred dollars to get an educated estimate of your wind resource at your home, put the service in perspective: you are pondering spending approximately $20,000-$80,000 on a residential wind turbine (before any incentives). People interested in the larger turbines in the small wind category will spend multiple hundreds of thousands of dollars for a system to supply all the electricity for their farm, school, or business. Realistically, a wind site assessment is a very small percentage of the total system cost, and could make the difference between wishful thinking and a substantial lowering of your utility bills.

If you are interested in such a service, contact your state public benefits program for assistance. In addition, some manufacturers are now training their dealers and installers in the art of wind resource assessment, and more are sure to follow as criteria for funding renewables projects inevitably tightens.

On the other hand, if you are content investing in a wind turbine with nothing more than a wet finger in the air to determine your wind resource…

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Editor's note: The opinions expressed in this column are the author's and may not reflect those of AWEA's staff or board.